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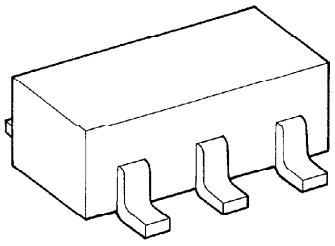
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC7SH14F, TC7SH14FU

SCHMITT INVERTER

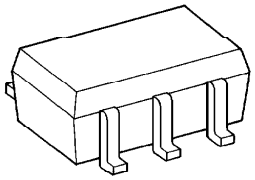
The TC7SH14 is an advanced high speed CMOS SCHMITT INVERTER fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. Pin configuration and function are the same as the TC7SH14 but the inputs have hysteresis and with its schmitt trigger function, the TC7SH14 can be used as a line receivers which will receive slow input signals.
An input protection circuit ensures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V system and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

TC7SH14F



SSOP5-P-0.95

TC7SH14FU



SSOP5-P-0.65A

Weight SSOP5-P-0.95 : 0.016g (Typ.)
SSOP5-P-0.65A : 0.006g (Typ.)

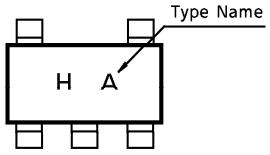
FEATURES

- High Speed ····· t_{pd} = 5.5ns (Typ.) at V_{CC} = 5V
- Low Power Dissipation ····· I_{CC} = 2μA (Max.) at Ta = 25°C
- High Noise Immunity ····· $V_{NIH} = V_{NIL}$ = 28% V_{CC} (Min.)
- Power Down Protection is provided on all inputs.
- Balanced Propagation Delays ····· $t_{pLH} \fallingdotseq t_{pHL}$
- Wide Operation Voltage Range ··· V_{CC} (opr) = 2V~5.5V

MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	V_{CC}	−0.5~7.0	V
DC Input Voltage	V_{IN}	−0.5~7.0	V
DC Output Voltage	V_{OUT}	−0.5~V_{CC}+0.5	V
Input Diode Current	I_{IK}	−20	mA
Output Diode Current	I_{OK}	±20	mA
DC Output Current	I_{OUT}	±25	mA
DC V_{CC}/Ground Current	I_{CC}	±50	mA
Power Dissipation	P_D	200	mW
Storage Temperature	T_{stg}	−65~150	°C
Lead Temperature (10 s)	T_L	260	°C

MARKING



TRUTH TABLE

A	Y
L	H
H	L

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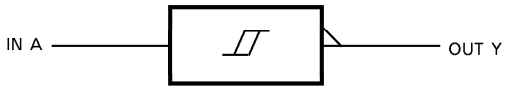
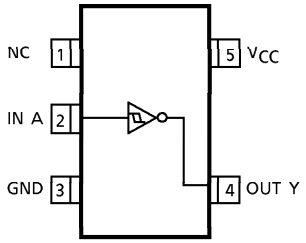
● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

LOGIC DIAGRAM



PIN ASSIGNMENT (TOP VIEW)



RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	2.0~5.5	V
Input Voltage	V_{IN}	0~5.5	V
Output Voltage	V_{OUT}	0~V_{CC}	V
Operating Temperature	T_{opr}	−40~85	°C
Input Rise and Fall Time	dt / dv	0~100 (V_{CC} = 3.3 ± 0.3V)	ns / V
		0~20 (V_{CC} = 5 ± 0.5V)	

DC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITION			Ta = 25°C			Ta = −40~85°C		UNIT
				V_{CC}	MIN.	TYP.	MAX.	MIN.	MAX.	
Positive Threshold Voltage	V_P			3.0	—	—	2.20	—	2.20	V
				4.5	—	—	3.15	—	3.15	
				5.5	—	—	3.85	—	3.85	
Negative Threshold Voltage	V_N			3.0	0.90	—	—	0.90	—	V
				4.5	1.35	—	—	1.35	—	
				6.0	1.65	—	—	1.65	—	
Hysteresis Voltage	V_H			3.0	0.30	—	1.20	0.30	1.20	V
				4.5	0.40	—	1.40	0.40	1.40	
				5.5	0.50	—	1.60	0.50	1.60	
High-Level Output Voltage	V_{OH}	V_{IN} = V_{IL}	I_{OH} = −50 μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			I_{OH} = −4mA	3.0	2.58	—	—	2.48	—	
			I_{OH} = −8mA	4.5	3.94	—	—	3.80	—	
Low-Level Output Voltage	V_{OL}	V_{IN} = V_{IH}	I_{OL} = 50 μA	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
			I_{OL} = 4mA	3.0	—	—	0.36	—	0.44	
			I_{OL} = 8mA	4.5	—	—	0.36	—	0.44	
Input Leakage Current	I_{IN}	V_{IN} = 5.5V or GND		0~5.5	—	—	±0.1	—	±1.0	μA
Quiescent Supply Current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	—	2.0	—	20.0	μA

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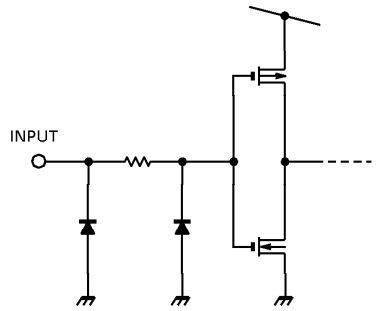
AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3ns$)

CHARACTERISTIC	SYMBOL	TEST CONDITION			Ta = 25°C			Ta = −40~85°C		UNIT
			V_{CC} (V)	C_L (pF)	MIN.	TYP.	MAX.	MIN.	MAX.	
Propagation Delay Time	t_{pLH} t_{pHL}		3.3 ± 0.3	15	—	8.3	12.8	1.0	15.0	ns
				50	—	10.8	16.3	1.0	18.5	
			5.0 ± 0.5	15	—	5.5	8.6	1.0	10.0	
				50	—	7.0	10.6	1.0	12.0	
Input Capacitance	C_{IN}				—	4	10	—	10	pF
Power Dissipation Capacitance	C_{PD}	(Note 1)			—	21	—	—	—	pF

(Note 1) : C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.
Average operating current can be obtained by the equation :

$$I_{CC\,(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

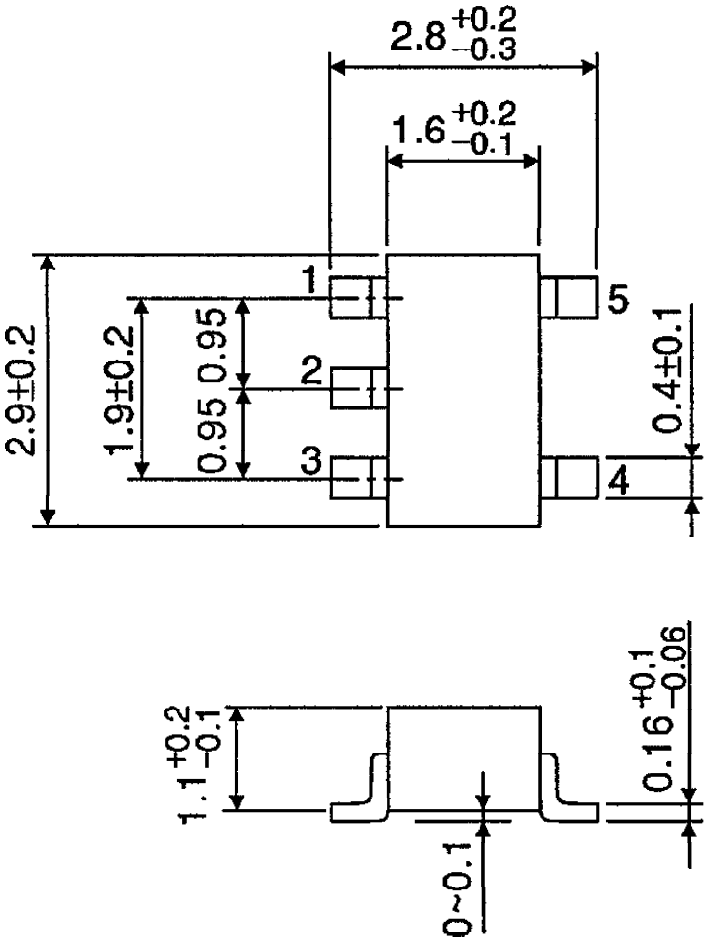
INPUT EQUIVALENT CIRCUIT



OUTLINE DRAWING

SSOP5-P-0.95

Unit : mm

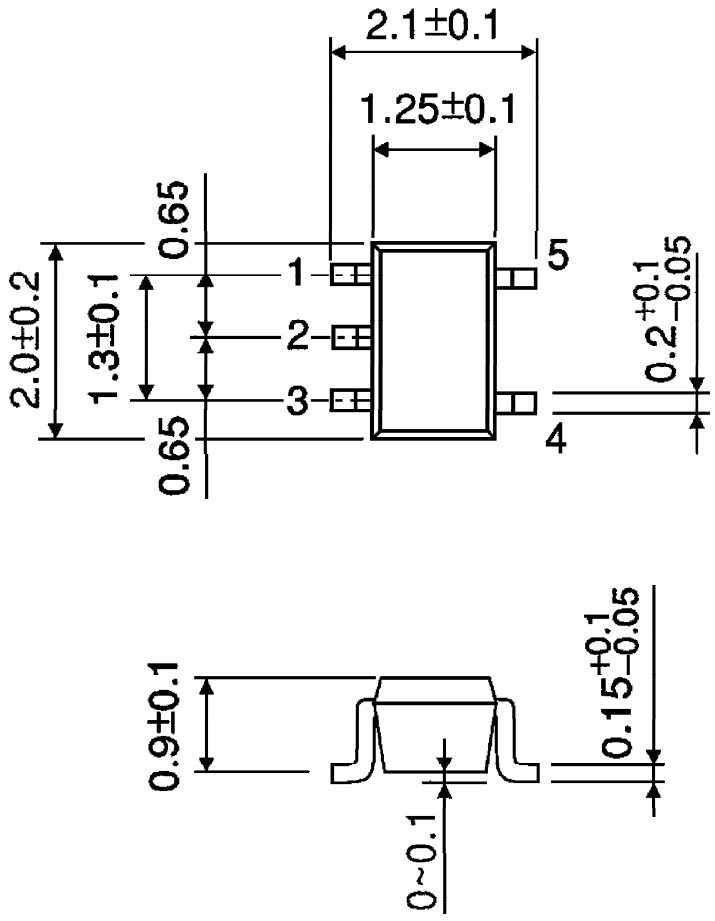


Weight : 0.016g (Typ.)

OUTLINE DRAWING

SSOP5-P-0.65A

Unit : mm



Weight : 0.006g (Typ.)